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DEVELOPMENT OF A PROTOTYPE PICO-SCALE POWER PLANT INTEGRATION

Dedi Tri Laksono

School of Electrical Engineering and Informatics, Bandung Institute of Technology, Bandung, Indonesia - 40132.

ABSTRACT

Practical work in power generator is one of subjects in Electrical Engineering Department, Faculty of Engineering. This subject give student knowledge and skill about integrated system in power generator. In the process of teaching and learning activity in practical work of power generator with the integrated system as the core material, it is found that lecturer lacks of trainer media about integrated system. This problem makes students less understand about how to plan, make, and operate integrated system which has advanced complicated system. This study adapts Sugiyono's developing model. In this developing model, each steps have revision in order to check the data validity and trainer qualification. Based on the try-out of this trainer, researcher gets the percentage from each subject as follows: (1) From media expert, the researcher gets the percentage 88.00%, (2) In the small group from the sample, researcher gets the percentage 89.60%, (4) In the big group from the sample, researcher gets the percentage 86.07%. From the data that researcher has, it can be concluded that the development of integrated prototype of pico-scale power generator is valid and proper to be used as instructional media for teaching and learning activities.

KEYWORDS: prototype, integration, power generation.

INTRODUCTION:

Today the world of electricity is growing rapidly. Proven almost always there is a new breakthrough about a renewable power plant. There are actually many small capacity power sources around us that are useful when combined. As an example of a combination of solar power plants – state electricity company, generator DC – state electricity company, and AC – solar power plants. The importance of electricity needs becomes one of the main factors in the development of electricity world.

In one of the subjects taken by students of electrical engineering education courses and D3 Electrical Engineering Department of Electrical Engineering Faculty of Engineering, State University of Malang is a course of laboratory power plant. In general, this course contains materials for generating electricity, types of power plants, installations at power plants, power generation principles, major problems in power generation, interconnection systems, power supply processes and power quality [1].

Practicum of electric power in engineering department of engineering faculty of state university of Malang is one of the hardest subject for students. Because students can only accept the theory or matter of power generation alone without knowing the whole of the power plant and how it works. In addition, there is no relevant media trainer, making this subject is sometimes difficult to be understood directly by the university students of engineering faculty.

In addition, the material complexity that can be proved by the number of materials or theories on power generation to be delivered, while the students have the capacity to remember and understand the limited and gradual. If you only refer to the textbook, it is certain that the learner will have difficulty understanding the material delivered with the real application of the power plant [2]. If the material presented is difficult, then what will happen is the motivation of learners to learn about the power plant will decrease.

In students there are mental powers that become the driving force of learning coming from various sources. If there is no balance between the desired with the media being taught, it may affect students' motivation in learning [3].

According to Hasan. S, reveals that "the media trainer is a set of equipment in a laboratory used as an educational medium that is a combination of work model and mock-up. Trainer is intended to support the learning of learners in applying the knowledge / concepts acquired on real objects ". The use of media trainer in learning is one effective way to increase learning interest of learners and is an external motivation that affects the internal motivation of students. The absence of a media trainer developed, allowing educators to use media trainers as learning solutions [4].

Media trainer system integration of pico-scale power plant has a power capacity of less than 5kW. That's why it's called a pico-scale power plant. This trainer is an interesting media to be given as an effort to support learning materials of lab power generator. Students can know firsthand how the pico-scale power plant integration system and experiment, so that learners quickly understand the material about the course of the power plant practicum through media trainer.

Integration of this power plant is the merger of two or more power plants and then operated together. The purpose of these two power plants is gain more power, for efficiency (saving on operating costs and saving on purchase costs), to facilitate the determination of power plant capacity, to ensure continuity of power availability, utilize small power sources [1].

To be able to integrate the power plant there are certainly some requirements that must be met. Some requirements to be able to integrate power plants are as follows [5]:

a. The second voltage of the power plant must have the same amplitude.

b. The second voltage of the power plant must have the same frequency.

c. Voltage on inter-power generation should be in phase.

The above requirements apply if two or more power plants to be integrated, two or more systems to be connected in parallel. A simple method that can be used to integrate two or more generators is used a lamp synchronous. It should be noted that the indicators used must be able to withstand twice the voltage between phases. There are several classifications of the power capacity of the power plant, among other things:

- Pico-scale: <500W
- Micro-scale: 05 – 100kW
- Mini-scale:100kW-1000kW
- Small-scale: 1MW–10MW
- Full-scale: >10 MW

MATERIALS AND METHODS:

When looking at the problems faced by researchers, then the appropriate development methods can use the model of Sugiyono. The basic concepts of research based on Sugiyono are reviewing the problem, then perform data collection, product design confirmation, validated product design, design revision, product trial, product revision, trial usage, product revision (refinement), mass production [6].

RESULTS:

From the data validation of media experts can be stated that the symbols in the table include X. X is the score of media experts and Xi expressed as the maximum score of media experts. The experimental results of media experts for trainers that the total score X is 88, while the total ideal score is 100. If made in the form percentage, then the test results of media experts have a value of 88%.

Looking at the results obtained from the above calculations, the results of media expert validation for pico-scale power plant integration trainers fall into very valid categories. This can be said to be a very valid category because the percentage of test results is more than the minimum category limit is very valid, 75%. Because more than 75%, this trainer can be declared good. The Results section should include the rationale or design, optimization, validation of the experiments as well as the results of the experiments.

Table 1. Result validation and level

Validator	X	Xi	Percent	Level
Media Expert	88	100	88%	Very valid

Media trainer products are given to small group trials. Research subjects in this small group trial amounted to 5 respondents. Five of these respondents were taken from a student of electrical engineering class which has taken the course of practicum of power plant. Similarly, data on individual test results, ΣX is expressed as the scoring score of the respondents, the value of ΣX is 448. If the percentage change is changed, it will be worth 89.6%. As for ∑xi is the ideal or maximum score that can be obtained by 500 points. From these data, it can be concluded that the results of small group testing can be declared very valid.

Data of large group trial result for product usage. On the table it can be seen that X1 states the score of the first student, X2 states the score from the second student, until X26 states the score of the twenty sixth students. ∑x represents the total score of all students, and ∑xi represents the ideal number of scores a student can gain. ∑x equal to 2238. Ideal value for each score that is 5, so we get ∑xi of 2600. The relationship between these factors is used to calculate Percentage (P) between ∑x to ∑xi using the following equation:

$$P = \sum x / \sum xi . 100\%$$
$$= 2238/2600 . 100\%$$
$$= 86.07\%$$

Based on the eligibility criteria, the percentage of scores on the usage test included in the qualification is very valid.

Table 2. Result validation trainer

Validator	∑X	∑Xi	Percent	Validation level
Small group	448	500	89,6%	Very Valid
Large group	2238	2600	86,07%	Very Valid

CONCLUSIONS:

Based on the results and data analysis of the development of power plant integration trainers that have been done, the trainers media have met valid and feasible criteria after going through a process of validation of media experts and material experts as well as small group trials and large group trials. Expert validation has 88% for media expert, while the small group and large group trial use gets percentage equal to 89,6% and 86,07%.

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REFERENCES:

1. Kadir, Abdul. 2010. Pembangkit Tenaga Listrik. Jakarta: Universitas Indonesia (UI Press).
2. Sadiman, Arif, dkk. 2002. Media Pendidikan. Jakarta: PT Raja Grafindo Persada
3. Arikunto, Suharsimi. 2006. Dasar-dasar Evaluasi Pendidikan. Jakarta: Bumi Aksara.
4. Hasan, S. 2006. Analisis Perakitan Trainer Unit Berdasarkan Aplikasi Konsep Refrigerasi pada Mata Kuliah Sistem Pendingin (Bahan Kuliah). Bandung: UPI.
5. Cara Kerja Generator. 2013. Kerja Generator Listrik, (Online), carapedia.com/kerja_generator_listrik_info2559.html. diakses tanggal 2 April 2013.
6. Sugiyono. 2011. Metode Penelitian Pendidikan (Pendekatan Kuantitatif, Kualitatif, dan R & D hal 298). Bandung: Alfabeta.